Analysis of a Pre-Work Stretching Program at Crystal Finishing Systems, Inc.

by

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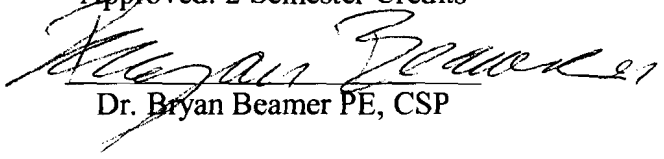

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ABSTRACT

Crystal Finishing Systems (CFS), Inc. in Schofield, Wisconsin, is constantly growing. With the increase in employees, the number of injuries is forecasted to increase as well. In order to prevent this, CFS has installed a stretching program to reduce the number of strains and sprains acquired in their painting applications facility. CFS would like to determine the benefit of the program in relation to the employee and production time and assets spent on it. The success of the stretching program was evaluated in a study of OSHA 300 logs in comparison with national averages, assessment of the stretching program currently employed, a survey on employee satisfaction, and a cost-benefit analysis. The results indicated that stretching does reduce the occurrence of strains and sprains, and the employees are satisfied with the program. CFS is

losing money annually with the implementation of the stretching program, but is meeting their goal of employee health and satisfaction.

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Chapter I: Introduction

Crystal Finishing Systems (CFS), Inc. has had a stretching program in place to reduce sprain and strain injuries for over two years. Whether this program is an efficient, cost effective method to control incidences of sprains and strains is not known, however. To sum up the problem, McAtee and Charland (1999) found the following:

> Proponents of stretching claim that it helps prevent injuries, prevents soreness, improves performance, promotes body awareness, stimulates blood flow, and is mentally relaxing and centering. Opponents argue that stretching is a waste of time, can actually cause injury, and does nothing to improve performance or prevent soreness or injuries. Each side has a multitude of studies, reports, and anecdotal evidence to support its claims. (p. 9)

Background of Company

CFS has grown astronomically in the past 12 years. It began as a single structure that painted aluminum materials in Weston, Wisconsin. All the work was done by just three employees; CFS now employs over 500. CFS has now expanded into a company that extrudes aluminum; liquid-and powder-coats plastics and aluminum products; fabricates parts to customer specifications; and delivers product throughout the US via their own fleet. From one building to five in just 12 years is a remarkable increase. As is consistent with current trends in American manufacturing, strains and sprains are a concern in the workplace at CFS.

Nationwide Trends

According to the Occupational Safety and Health Administration (OSHA), 60% of all work-related musculoskeletal disorders (MSDs) actually occur in manufacturing

and so-called manual handling jobs (Towle, 2000). Muscular strains are among the most prevalent as well as the most frustrating groups of injuries for athletes and health care professionals (Cross & Worrell, 1999). Most MSDs and repetitive motion injuries (RMI), such as carpal tunnel syndrome, can be considered a muscular sprain or strain. According to the U.S. Bureau of Labor Statistics (Barney & Barney, 1999), RMI trauma cases have escalated 1,000% from 1972-1994, making worker compensation claims reach a record $20 billion annually. Muscular strains are an increasing problem that is generally caused in manufacturing industries.

Causes of the Problem

Static postures such as sitting or standing can reflect muscular imbalances and result in inflexibility and potential for injury (Speer, 2005). Physical effort required from each employee differs from job to job. Most employees at CFS are required to do a great deal of moving objects that can be awkward or heavy. Lifting awkward objects typically involves using deviant postures to make moving the object easier. While moving these items, the employees are constantly grabbing, pushing, pulling, lifting, twisting, reaching, bending and sometimes even kneeling which make them more prone to straining or spraining their muscles. Most workers work long days of at least 10 hour shifts on their feet and continually do the same repetitive task.

Trends at CFS

With the rise in CFS' workforce, the number of injuries has also increased. An investigation of previous years' Occupational Safety and Health Association (OSHA) 300 forms revealed that the number one injury at CFS is a muscular strain or sprain, making up slightly over 40% of all injuries and costing the company thousands in workers'

compensation claims. In order to reduce the amount of injuries, mainly strains and sprains, CFS has begun a stretching program in the division identified as having the most incidents.

Possible Solutions

Across America, stretching has been proposed as a possible solution to the problem of sprains and strains. For example, according to Saunders and Anderson, employee flexibility and endurance increased through stretching programs can help prevent muscle strains (1992). Stretching should be done before an activity, ideally at the start of the day, and after one has been sitting too long or as part of a cool down (Department of the Army, 2003). Stretching is shown, through recent studies, to significantly influence the viscosity of tendons and make it more compliant which is important for injury prevention (Wivrouw, Mahieu, Danneels, & McNair, 2004).

Problem Statement

Reduction of work related injuries may correlate with a pre-shift stretching program at CFS. Incident reports, review of literature, and a survey of workers will be used to determine the influence of the stretching program.

Purpose of the Study

The purpose of this study is to determine whether the stretching program at CFS is effectively reducing the amount of strains and sprains and to discover employee satisfaction with the stretching program.

Significance

As CFS grows, the demand for employees also rises. With the increase in employees, it is assumed that the amount of injuries will also rise. The company does not

want this to happen. This study is necessary to prove that the company is not wasting valuable assets, employee and production time, by stretching before work. The company's main goal is to protect its workers from injury.

Assumptions of the Study

It is assumed that each employee is willingly and actively participating in the stretching program and that they are correctly following all the stretching exercises.

Definition of Terms

Carpal tunnel syndrome. "Carpal tunnel syndrome is a specific group of symptoms that can include tingling, numbness, weakness, or pain in the fingers, thumb, hand, and occasionally in the arm. These symptoms occur when there is pressure on the median nerve within the wrist" (WebMD, 2006).

Musculoskeletal disorders (MSD). "Injuries and disorders of the muscles, nerves, tendons, ligaments, joints, cartilage and spinal disc" (Ergo Web, 2006).

Repetitive motion injury (RMI). "Any of various painful musculoskeletal disorders (as carpal tunnel syndrome or tendonitis) caused by cumulative damage to muscles, tendons, ligaments, nerves, or joints (as of the hand or shoulder) from highly repetitive movements - called also *repetitive strain injury*" (Merriam, 2006a)

Sprain. "A sudden or violent twist or wrench of a joint with stretching or tearing of ligaments" (Merriam, 2006b).

Strain. "To draw or stretch tight a ligament or muscle. Results from working a muscle beyond its normal capacity" (Workers' Compensation Help Center, 2004-2007, para. 69).

Viscosity. "The condition or property of being viscous. The degree to which a fluid resists flow under an applied force, measured by the tangential friction force per unit area divided by the velocity gradient under conditions of streamline flow; coefficient of viscosity" (Stedman's, 2002).

Workers' compensation. Compensation for injury to an employee arising out of and in the course of employment that is paid to the worker or dependents by an employer whose strict liability for such compensation is established by statute.

NOTE: Where established by statute, workers' compensation is generally the exclusive remedy for injuries arising from employment, with some exceptions. Workers' compensation statutes commonly include explicit exclusions for injury caused intentionally, by willful misconduct, and by voluntary intoxication from alcohol or illegal drugs (Merriam, 2006c).

Limitations of the Study

The limitations identified to the study are as follows:

1. Each employee must put forth effort to the stretching program.
2. The stretching program is currently installed in only one plant of five, limiting the possible outcomes.
3. It is hard to differentiate if the reduction of injuries is caused by stretching or if the workers are being more cautious, or if there are other unidentified reasons.
4. Some repetitive motion injuries, carpal tunnel syndrome, or any other muscular skeletal disorder could be contributed to employee lifestyle and caused or brought about from things that happen outside work.
5. It is assumed that all injuries are reported when they happen.

6. The calculations in the cost benefit are as current as possible; they do not necessarily reflect future costs of the stretching program.

7. Data gathered is limited to two years prior the stretching program and two years after. The data from the first year the stretching program was implemented seems to be aberrant.

Chapter II: Literature Review

In sports and other activities, stretching has been used for years to reduce the amount of injuries. Stretching has now made its way into the workplace to reduce the occurrence of strains and sprains. This chapter will show some results of plants that have instituted stretching programs, how stretching works, and some different types of stretching that can be helpful to the reduction of muscular strain and sprain injuries when done properly. The Hawthorne studies will also be reviewed.

Stretching Programs

Over the years stretching has become more and more popular in the industrial field with companies installing stretching programs across the globe. These programs are usually aimed at reducing the amount of strains and or sprains in the workplace. The following article reviews some examples.

In a study conducted at the University of Indianapolis found that hamstring, quadriceps, hip adductors and gastrocnemius-soleus muscular sprains, located at the ankle, are the most common muscular injuries in the lower extremity (Cross & Worrell, 2002). In order to reduce these incidents the researchers first broke down the way in which these injuries occurred. It turned out to be an interaction between four determining factors: warm-up, strength, fatigue, and flexibility. Flexibility was identified as the primary etiologic factor and was, therefore, focused upon. The theory was that if less tension was applied within the muscular tissue when it was subjected to changes in joint motion that accompany sport or recreational activity, the potential for muscular strain throughout the normal range of motion will be reduced by elongation of the muscular

unit. This goes to show that stretching reduces the chances of straining or spraining a muscle.

In another case, 195 medical records of Division III college football players from the 1994-1995 season were studied (Cross, 1994). One hundred and fifty five total injuries occurred, of which 27.7% were lower extremity muscular strains. In 1995 the researcher in this case incorporated a static stretching program to the team's regimen of exercise. Each stretch was performed three times a day and held for 15 seconds each time. These stretches were aimed at the quadriceps, hamstrings and hip adductors. After the 1995-1996 season, there were a total of 153 injuries with only 13.7% being of the lower extremity muscular strains. This is a decrease of almost 50%. The researchers believed that, in this study, the reduction in muscular strains was associated with the stretching program that was instilled. This again is showing that stretching is successful at reducing the amount of strains and sprains that can occur with regular muscular exercise.

In Macedon, New York a company determined that ergonomically correct work stations were not doing enough alone to reduce the amount of cumulative trauma injuries caused by the repetitive nature of the work at their factory (DeWeese 2006). A stretching program was installed that was specific for each employee's task and designed to be short duration exercise that could be done right at their workstations. The program reduced plant wide recordable injuries from 23 in 1998 to 16 in 2004. It also lowered the incident rate from 5.3 in 1998 to 3.37 in 2004 and reduced turnover rate from 26% in 1998 to 17% in 2004. In this case they felt the program worked because it instilled a feeling of high

morale and importance into the employees and showed them how the company valued them as employees.

In another study, the purpose was to implement a primary prevention program that targeted to prevent muscle strains (Moore, 1998). Physiologic perception measurements were taken before and after participation in a stretching program that was developed to improve flexibility through conditioning. A one group pre-test post-test design was used with 60 employees enrolled in a 36 session stretching program in the workplace. Flexibility profiles were created for each employee measuring sit and reach test scores, bilateral body rotation measurements, and shoulder rotation measurements. A statistically significant increase was found in all flexibility measurements at the conclusion of the study for the participant group. Also at the conclusion, the employees' self perceptions of body attractiveness, physical conditioning and overall self worth were all significantly different. All the participants who completed the stretching program had zero occurrences of musculoskeletal injuries during the two month period. The results of this study indicate that the continued development and implementation of stretching programs in the workplace may benefit employees by increasing flexibility and potentially preventing injuries due to muscle strains. Stretching programs may also improve employees' perceptions of their physical bodies.

How Stretching Works

In the field of sports training and exercise, stretching is one of the most misunderstood components of fitness (Bracko, 2002). When people stretch, the muscles and tendons attached are stretched so that their viscous-elastic properties are responsible for increasing the length of the muscle. Golgi tendons and muscle spindles within the

muscle and tendon help protect the muscle from being overstretched. Golgi tendons are highly sensitive receptors that provide sensory information to the brain about changes in length and tension changes in the muscle. Near the junction of the muscle is where the Golgi tendons are located. Their primary function is to monitor the amount of tension placed on a tendon; if it is too great of an amount the Golgi causes a reflex inhibition in the muscle. This reflex causes the muscle to relax and thus protects the muscle and tendon from injury.

The muscle spindle is functionally important in exercise or sports because it has the capability of detecting, responding to and making changes in the length of skeletal muscles (Bracko, 2002). The primary function of the muscle spindle is to respond when stretching occurs and evoke a muscular reflex action that reduces the stretch that protects the muscle and tendon from injury. The muscle spindle is located parallel to regular muscle fibers and stretches when they stretch. Inside of the muscle spindle there are specialized fibers called intra-fusal fibers which contain actin and myosin which make it possible for spindle muscles to contract. The muscle spindle monitors the amount of stretch on a muscle and tells the muscle when it is too much, or perceived as dangerous. The intra-fusal fibers of the muscle spindle then contract causing the stretching to stop and prevent injury.

Different Types of Stretching Exercises

Stretching is very important in the reducing the possibility of attaining a muscular strain or sprain. There are four main types of stretching exercises: static stretching, passive stretching, proprioceptive neuromuscular facilitation (PNF) stretching, and ballistic stretching which is sometimes known as dynamic stretching. Each type varies

the amount of work done in the muscles and its affects on the body prior to work being done by these muscles.

Static stretching. Static stretching exercises are the most commonly used type of stretching (Mee, 1987). It is easily accomplished and can be done alone at just about any location where there is enough space. In static stretching, the muscle is stretched until there is a feeling of resistance or beginning of discomfort ("Stretching," 1994). This posture is then held for up to 30 seconds, but most commonly only held for 10 seconds. Static stretching does not include any bouncing, so once the feeling of resistance is reached, that posture is held. This is then repeated multiple times throughout the day. Static stretching varies only slightly from passive stretching which usually requires assistance from another object to assist in the stretching process.

Passive stretching. Passive stretching is similar to static stretching in the fact that you stretch the muscle to the point of beginning discomfort or resistance. This posture is then held just like in static stretching. The main difference between static stretching and passive stretching is that in passive stretching the point of discomfort or resistance is gained by using equipment or the assistance of another to reach this point. The equipment can be a towel, pole or even rubber tubing to help stretch (Department of the Army, 2003). Communication is important in passive stretching so that the partner does not over stretch the muscles for you. Static and passive stretching are very similar but are much different from the other types of stretching.

Proprioceptive neuromuscular facilitation (PNF) stretching. PNF stretching uses the neuromuscular patterns of each muscle group to help improve its flexibility (Department of the Army, 2003). In the PNF stretching process, intense muscular

contractions and relaxations are used. First the muscle is contracted against a resistance, usually with the assistance of equipment or another person. The muscle is then relaxed into a static extension of the muscle and held. This allows for a greater ability to stretch in a wider range of motions ("Stretching," 1994). As in passive stretching, PNF stretching also utilizes the support of a partner or equipment.

Ballistic or dynamic stretching. Ballistic or dynamic stretching involves the movements of bouncing or bobbing to attain a greater range of motion in stretching (Department of the Army, 2003). This method does improve flexibility but often forces a muscle to stretch too far and can result in injury. Ballistic stretching does more harm then good by actually shortening muscles because of a proactive reflex contraction done by a muscle, which usually leads to tears or ripping of the muscle ("Stretching," 1994). The Army does not suggest this type of stretching for any of its individuals or units.

Cost-Benefit Analysis

According to Mind Tools (2007), a cost-benefit analysis is a relatively simple way of deciding whether or not a change is worthwhile. A cost-benefit analysis is just what it implies; the value of the benefits compared to that of the costs of associated with the change. A cost-benefit analysis also determines the payback time simply by dividing the total costs by the total benefits.

Hawthorne Effect

The Hawthorne Effect gets its name from a series of studies that took place in a factory called Hawnthorne Works, owned by Western Electric Company (Adair, 1984). These studies took place in 1924 and 1932. There were many different types of studies performed on the workers. The main purpose of the study was to see the effects that

different lighting situations had on employee production. The study found that employees' production was increased in every increase or decrease in lighting. There was also a study done on female employees with the help of Harvard University professors. This study focused more on changing the environment of the workers, each time the result being that employee production went up. Overall, the Hawthorne Effect can best be described as how people will respond positively to any novel changes in their work environment.

Summary

A review of the literature suggests that the development and implementation of stretching programs reduce the amount of strains and sprains in frequently worked muscles. This effect can be greatly increased by doing stretches that target specific muscles that are used repeatedly. In addition, static stretching techniques are the most universally used type of stretching when trying to reduce strains and sprains. A cost-benefit analysis can be used to determine if the benefits of the stretching program are monetarily worth more than the costs of the program. Through the Hawthorne Effect, employees may have a greater response to the stretching knowing the company cares for their health.

Chapter III: Methodology

Introduction

The purpose of this study is to determine whether the stretching program at CFS is effectively reducing the amount of strains and sprains and to discover employee satisfaction with the stretching program. This will be completed by examining incident rates from the past OSHA 300 logs, analyzing the stretching program techniques currently used, and reviewing a pre-existing survey. The years prior to the stretching program, 2003 and 2004, and one year after the program, 2006, will be used in the data collection and comparison of incidents.

OSHA 300 Logs

The Occupational Safety and Health Administration (OSHA) requires that all companies with more than 10 employees fill out an OSHA 300 log annually. The OSHA 300 log describes when an incident occurred, where it occurred and how the employee was affected. The specific OSHA 300 forms used in this research can be found at 2610 Ross Avenue, Schofield Wisconsin 54476. They are in the downstairs Environmental Health and Safety (EHS) department, both in paper and electronic form. The OSHA 300 forms of years 2003, 2004, 2005, and 2006 were gathered and data was collected directly from these to determine the number of strains and sprains that occurred each year under the facility that currently utilizes the stretching program. The OSHA logs are also kept on digital file on the server located at U:\Jeffe\Workers compensation\ followed by the year and the specific OSHA 300 form for that year is found in that folder. As with most companies, a password is needed to access the network. Copies of the OSHA 300 logs can be found in the Appendix A. To preserve employee anonymity, names have been cut

off of the forms. Information needed from the OSHA 300 log is under the section titled case description and under this section the column F was most used to determine if the injury was a strain or sprain.

Stretching Techniques

The facility that currently uses the stretching program is located at 4807 Bayberry Street, one block due east of where all the OSHA 300 logs are kept. The techniques utilized are in picture format on a poster in the facility that uses it. The drawings originally came from Marshfield Clinic who gave them to CFS when they spoke of creating a stretching program. There are also backup copies of these stretches on standard paper in the EHS office located at 2610 Ross Avenue. No electronic copies are kept on file. The researcher photocopied the documents which are in Appendix C.

Survey Results

A simple survey was done in the summer of 2006 to see if employees were satisfied with the stretching program. Employees that were currently in the stretching program were asked verbally one by one if they were satisfied with the stretching program. The surveyor then wrote if they responded with a positive, negative or middle view response. The surveyor then collected their response as to why they felt this way about the stretching program. All data was then compiled into an Excel spreadsheet. This data can be found on the CFS server at U:\Jeffe\safety folder\Stretching info & pics \ stretchsatisfaction.excel. A password will be needed to gain access to the CFS network or their server. A copy of the results of this survey can also be found in Appendix D.

Data Analysis

Data will be used in a comparative analysis. Frequencies of strains and sprains for each year will be gathered. If the years after implementation of the stretching program show improvement over the years before the stretching program was implemented, then these results would suggest that the program is effective in reducing the amount of strains and sprains at CFS. These numbers will also then be used to compute injury rates to be compared to national trends in industries similar to CFS. The national statistics will be taken from www.bls.gov. The year 2006 cannot be compared because the Bureau of Labor Statistics (BLS) does not have this information posted at the time this paper is being written. The statistics taken from the BLS can be found in Appendix B.

Cost-Benefit Analysis

The cost-benefit analysis will be used to determine if the stretching program is worth implementing. It will compare the costs of employees taking the time to stretch and compare it with the benefits of reducing the amount strains and sprains. The cost of time will be determined by multiplying the employees' pay with benefits and by how much time it will take to do the stretching.

The costs of strains and sprains will be determined by using a program called $afety pays. This program can be found at www.osha.gov/dts/osta/oshasoft/safetwb.html. $afety pays is a program designed to estimate the costs of different types of injuries using the profit margin of the company. If the profit margin is not known, the program will automatically use 3%. A 3% profit margin was used in this cost-benefit analysis. The results of this can be found in Appendix E.

Chapter IV: Results

The purpose of this study is to determine whether the stretching program at CFS is effectively reducing the amount of strains and sprains and to discover employee satisfaction with the stretching program. This will be completed by looking at incident rates from the past history OSHA 300 logs, analyzing the stretching program techniques currently used, reviewing a pre-existing survey, and by doing a cost-benefit analysis. In this chapter, all the results of each of the categories will be discussed.

OSHA 300 Logs

In the OHSA 300 logs from CFS located in Appendix A, the number of employees injured per year from strains and sprains was collected by the researcher. Cases that were denied by CFS' workers' compensation insurance provider are lined out; these cases were not included in the total. A table with the total number of cases per year including the number of employees in that year is listed below.

Table 1

Strain and Sprain Cases Employee Numbers Per Year

	2003	2004	2005	2006
Strains and Sprains	2	4	4	5
# of Employees	36	51	68	153
Ratio	2/36= 0.056	4/51= 0.078	4/68= 0.059	5/153= 0.033

The ratio of strain and sprain injuries per employee has gradually decreased since the stretching program was introduced in 2005. Prior to the stretching program, it seemed as though the injury per employee ratio was increasing.

Stretching Techniques

Figures of the stretching techniques done by CFS employees can be found in Appendix C. These stretching techniques target specified muscle areas that are used in the daily operation of painting, buffing and sanding. Employees in these areas do the stretching program at least before they start work each day. The total stretching process takes from seven to 10 minutes. To increase employee participation, the stretching is done in one big group with a different leader each day. The leader is a voluntary position, where as the stretching program is not. The stretching technique outlined in the program that is located in the appendix utilizes static stretching techniques. Through the review of literature, these were found to be the most commonly used type of stretching to reduce injuries.

Survey Results

In the survey, employees were questioned individually, in person, by a surveyor. The surveyor asked the employees if they felt the stretching program was good and why. The results were recorded and can be found in Appendix D. As indicated in the table below, the great majority of the employees had a positive response to the question and thus felt the stretching program was worth while.

Table 2

Employee Responses to Survey Question

Response	Frequency
Positive	28
Middle or Neutral	3
Negative	5
Total	36

Any persons involved in the stretching program on that day were questioned, including supervisors and line managers. In Appendix D, there is a graph showing the reasons employees cited for their response of positive, neutral, or negative. The majority of employees felt as though the stretching program was positive because it helped wake them up in the morning and made them feel more energetic. Another of the most common responses was that it gave them increased flexibility and they felt more limber and loose after doing the stretches. All the negative responses can be summed up in the following statements: they felt it was a waste of time; it hurt them; or they did not see the point in having to do it.

Data Analysis

The BLS has an inventory of all injuries recorded for every year from every type of industry. The researcher gathered information from BLS that will be used to do a comparison of how CFS compares to national injury trends. The BLS records their data of in terms of injuries per 10,000 employees. In order to make this comparable, the number of injuries per 10,000 employees was divided by 10,000. This gives you the

number of injuries per employee. In order to make the BLS average comparable to that of CFS, the researcher then multiplied that number by the number of employees at CFS. The new injury per year number was then compared to the number of strain and sprain incidents that CFS had that year. The results can be found below in Table 3.

Table 3

BLS Injury Rates Compared to CFS Data

Year	Bureau of Labor Statistics # of injuries normalized for CFS data	Crystal Finishing Systems
2003	92.5/10000*36= 0.33	2
2004	38.4/10000*51= 0.19	4
2005	85.5/10000*68= 0.58	4
2006	No Data	5

There is no data for 2006 from the BLS; they are not done compiling the information yet. When CFS is compared to a company of similar size, number of employees, average number of cases per year it seems as though CFS is way above the norm. This is because there is not significant and specific enough data to do a more realistic comparison. The researcher had to extrapolate the average number of injuries for a company similar in size to CFS.

Cost-Benefit Analysis

A cost-benefit analysis was done to see if the program was cost effective at reducing the amount of strains and sprains at CFS. When the data gathered from the $afety pays program (Appendix E) is averaged to find the average cost of either a strain ($13,079) or a sprain ($11,037) the total comes to $12,058. This number will be used as the estimated total benefit for reducing injuries by one strain or sprain. The estimated total cost for implementing the stretching program can be found in the table below. The pay rate used represents the worst case scenario, representing the employee who makes the most, plus his or her benefits.

Table 4

Estimated Daily Cost of Using the Stretching Program

Type of Worker	# of Workers	Pay Rate ($ per hour, incl. benefits)	Pay Rate ($ per minute)	Minutes Per Day	Total Cost Per Day
General Laborer	90	$14	$0.24	10	90*$.24*10= $216

Since employees do not work just one day, it would be beneficial to know the cost of the program for the entire year. This would make it easier to compare when reducing one injury of a strain or sprain per year. CFS generally works 50 weeks a year, and normally 5 days a week. That makes 250 days of the stretching program per year. Multiply the cost of one day by 250 and the total cost per year of the program becomes $54,000.

Another way to do the cost-benefit analysis is to evaluate how much the strain and sprain incidents cost the company per employee. This makes it possible to see how much

the company is saving for each strain and sprain incident or how much more they are spending per employee per incident over the years.

Table 5

Total Estimated Cost Per Strain or Sprain Injury Per Employee

	2003	2004	2005	2006
Assumed Average Cost of Each Incident	$12,058	$12,058	$12,058	$12,058
Number of Incidents	2	4	4	5
Total Cost Per Year	$24,116	$48,232	$48,232	$60,290
Number of Employees	36	51	68	153
Cost of Accidents Per Employee	$669.89	$945.73	$709.29	$394.05

The data presented in Table 5 above indicates that the costs of strain or sprain injuries per employee have gone down after implementation of the stretching program. This is due to the overall reduction of injuries per employee.

It is important to compare this to another factor: the cost of having employees participate in the stretching program. When comparing 2006 with 2003 and 2004, CFS saved $413.75 per employee on average. To get this number, the average cost per employee for 2003 and 2004 was determined; this was then subtracted from the cost of accidents per employee in 2006. The overall reasoning is that this difference is money saved since there were fewer accidents per employee in 2006.

Table 6

Cost of Employee to Stretch Each Year

Hourly Rate	Hours per Year	Total Cost per Employee of Implementing Program
$14.30	33.3	$476.19

A cost-benefit analysis can now be done on a per-employee basis. Doing this will keep the units for all data common so that a comparison of like items can be made. In the years prior to the program, it is clear that implementing the program costs more than what was saved after the program was implemented. In fact, by the reckoning presented in this research, the company lost about $62 per employee ($476.19 cost of program per employee minus the $413.75 saved per employee). For the year that the stretching program was introduced, 2005, it is hard to say whether or not the stretching program had any effects on reducing strains or sprains, so it should not be included in the comparison. Taking the savings from above, $413.75, and then comparing it to the cost for implementation per employee $476.19 it goes to show that it costs CFS $62 per employee per year. The total cost for CFS for 2006 is $9,552.

Discussion

Through this chapter it has been discovered that the stretching program may be reducing the incident-to-employee ratio for sprain and strain injuries. When compared to BLS data, CFS is above national averages for strain and sprain incident rates. The stretching techniques currently implemented are the correct way to reduce strains and sprains. The survey results show that employees are generally satisfied with the program. The Hawthorne study suggests that the stretching program reducing strains and sprains

may be due to CFS showing concern for employee wealth. The cost-benefit analysis shows that it is currently costing CFS more money to implement the stretching program than it is truly saving by reducing strains and sprains.

However, there are many generalizations made in the comparison that skew the results such as using maximum pay for employees with benefits, maximum time for the stretching program, and the $afety pays program to determine costs of strains and sprains. These all play an important role in generating the costs and benefits. However, even if the numbers were smaller, CFS would still probably be losing money by implementing the program. It is important to remember that the goal of the program is to reduce strains and sprains and the OSHA 300 logs show that stretching is effective at doing that. Most companies do not use strict cost-benefit analysis when taking into account safety of employees. The cost-benefit analysis also does not take into effect the non-monetary benefit of having satisfied workers, which is proven through the survey.

Chapter V: Conclusions and Recommendations

The purpose of this study is to determine whether the stretching program at CFS is effectively reducing the number of strains and sprains and to discover employee satisfaction with the stretching program.

Conclusions

Through the study of OSHA 300 logs, currently employed stretching techniques, a review of a survey, and a cost benefit analysis, data shows the following:

- The stretching program dramatically reduces the amount of strains and sprains when taking into account the increasing number of employees.
- The stretching techniques currently used are sufficient, when correctly done, in order to reduce the amount of strains and sprains.
- Employees are satisfied, overall, with the stretching program and enjoy the way that it makes them feel after performing these stretching activities.
- The stretching program is costing CFS money each year and not necessarily saving money by reducing strains and sprains.

Recommendations

This research has shown that the stretching program is not doing enough when compared to national averages of injury rates. The researcher recommends that CFS

- Dig deeper for root causes of the strains and sprains by inspecting workstations, interviewing employees and investigating injury reports.
- Engineer better designed workstations for employees with adjustable work heights.

- Use lighter paint guns, buffers and sanders. This would dramatically reduce the strain on muscles that are used to do work.
- Employ job rotation for involved employees; make sure that the job they are rotating to do not use the same embattled muscle groups from their previous job.
- Increase training on proper use of tooling to prevent injury, staying within manufacturer recommendations.
- Continue to implement the stretching program. Even though it is believed that the stretching program does not currently pay for itself by preventing all sprains and strains, there are many non-monetary benefits including increased employee satisfaction. Furthermore, as the stretching program is implemented over several years, the trend identified from 2005-2006 of decreased injury rates may continue to improve.

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Type Appendix A: OSHA 300 Logs Used for Data Gathering of Injury

:00

-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 2003

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no 1218-0176

k-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or t also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional id illnesses that meet any of the specific recording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for ete an injury and illness incident report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If call your local OSHA office for help.

Establishment name Crystal Finishing Systems, Inc. Facility 3

City Schofield State Wisconsin

Describe the case				Classify the case										
				Using these categories, check ONLY the most serious result for each case.				Enter the number of days the injured or ill worker was		Check the "injury" column or choose one type of illness.				
(C) Job Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death	Days away from work	Remained at work		On job transfer or restriction (days)	Away from work (days)	(M) Injury	Skin Disorder	Respiratory Condition	Poisoning	All other illnesses
						Job transfer or restriction	Other record-able cases							
				(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)
aborer	05/05	Fiberglass Sanding Area	Right Shoulder Strain			X		8	0	x				
ainter	07/23	Fiberglass Paint Vault	Smashed left middle finger tip		X			0	4	x				
aborer	08/11	Powder Line	Twisted R ankle			X		4	0	x				
ainter	09/10	Powder Line	Twisted left wrist			X		88	6	x				
ainter	09/10	Powder Line	Left leg and foot burn		X			17	7		x			
upervisor	10/08	Powder Line	Low back strain			X		8	0	x				
aborer	12/30	Powder Line	Smashed / pinched right finger (pinky)				x	0	0	x				
aborer	05/03	Powder Line	Rash on R hand				x	0	0		x			
			Page totals	*0*	*2*	*4*	*2*	*125*	*17*	*6*	*2*	*0*	*0*	*0*

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

	Injury	Skin Disorder	Respiratory Condition	Poisoning	All other illnesses
	(1)	(2)	(3)	(4)	(5)

formation is estimated to average 14 minutes per response h and gather the data needed, and complete and review the quired to respond to the collection of information unless it ... If you have any comments about these estimates or any Department of Labor, OSHA Office of Statistics, Room N 3644 0210. Do not send the completed forms to this office.

300A
Work-Related Injuries and Illnesses

Year 2003

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1219-0176

I must complete this Summary page, even if no injuries or
remember to review the Log to verify that the entries are complete

es you made for each category. Then write the totals below.
om every page of the log. If you had no cases write "0."

representatives have the right to review the OSHA Form 300 in its
to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in
details on the access provisions for these forms.

ber of days work	Total number of cases with job transfer or restriction	Total number of other recordable cases
	4 (I)	2 (J)

Total number of days away from work
17 (K)

	(4) Poisoning	0
	(5) All other illnesses	0

February 1 to April 30 of the year following the year covered by the form

ration is estimated to average 50 minutes per response, including time to review the instructions, search and gather lection of information. Persons are not required to respond to the collection of information unless it displays a y comments about these estimates or any aspects of this data collection, contact: US Department of Labor ...ruction Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name: Crystal Finishing Systems, Inc. Facility 3

Street: 4807 Bayberry St.

City: Schofield State: WI Zip: 54476

Industry description (e.g., Manufacture of motor truck trailers)
Coatings Applicator

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)
3 4 7 9

Employment information

Annual average number of employees: 35.5

Total hours worked by all employees last year: 91574.3

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Company executive | Title

Phone | Date

Revised by Jeff Eisenreich per OSHA Requirements - Effective 1-1-2004)

Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 2004

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

'jury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid
id illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet
04.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an injury and illness incident report (OSHA Form
id on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name PLANT 3

City _____ State _____

Describe the case				Classify the case											
(C) Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Using these categories, check ONLY the most serious result for each case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
				Death	Days away from work	Remained at work		Away from work (days)	On job transfer or restriction (days)	(M)					
						Job transfer or restriction	Other record-able cases			Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
				(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
der Painter	2/21	Powder Booth	Employee struck in head by another using powder gun				X	0	0	X					
Laborer	4/2	Powder Racking	Foreign body in L eye				X	0	0	X					
r	5-26	Fiberglass	Trapezious strain			X		0	5	X					
Fiber	6-30	Fiberglass	Laceration shin - 3 sutures				X	0	0	X					
ier	7-1	Fiberglass	R shoulder strain			X		0	3	X					
ier	4-4	~~Fulton~~	~~Illness (cause unknown)~~					~~0~~	~~0~~						
	10-11	Fiberglass	R bicep strain (later diagnosed as rotator cuff)		X			10	45	X					
	10-27	Fiberglass	Upper back strain			X		0	7	X					
			Page totals	*0*	*1*	*3*	*3*	*10*	*60*	*7*	*0*	*0*	*0*	*0*	*0*

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
(1)	(2)	(3)	(4)	(5)	(6)

is estimated to average 14 minutes per response, including time to
id, and complete and review the collection of information. Persons
on unless it displays a currently valid OMB control number. If you
ts of this data collection, contact: US Department of Labor, OSHA
, NW, Washington DC 20210. Do not send the completed forms to

00A Revised by Jeff Eisenreich per OSHA Requirements, effective 1-1-2004

Work-Related Injuries and Illnesses

Year _____

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

must complete this Summary page, even if no injuries or
ember to review the Log to verify that the entries are complete

s you made for each category. Then write the totals below.
n every page of the log. If you had no cases write "0."

epresentatives have the right to review the OSHA Form 300 in its
o the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in
etails on the access provisions for these forms.

ıer of days work	Total number of cases with job transfer or restriction	Total number of other recordable cases
	3	3
	(I)	(J)

Total number of days of job transfer or restriction

60
(L)

	(4) Poisoning	0
	(5) Hearing Loss	0
	(6) All other illnesses	0

February 1 to April 30 of the year following the year covered by the form

ation s est mated to average 50 m nutes per response, inc uding time to review the instruction, search ang gather ection of informat on. Persons are not required to respond to the collection of information unless it displays a ny comments about these estimates or any aspects of this data collection, contact US Department of Labor stitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name Crystal Finishing Systems, Inc. Plant 3

Street 4807 Bayberry St

City Schofield State WI Zip 54476

Industry description (e.g., Manufacture of motor truck trailers)
Coatings Applicator

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)
3 4 7 9

Employment information

Annual average number of employees 51

Total hours worked by all employees last year 97213.5

Sign here

Knowingly falsifying this document may result in a fine

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Mark Matthiae
Company executive

President
Title

715-355-5351 x225
Phone

2/1/2005
Date

(Rev. 01/2004)

Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 2005

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment i-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related ording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA

Establishment name: Crystal Finishing Systems - Facility 3

City: Schofield State: WI

Describe the case				Classify the case											
(C) de (e.g., lder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
				Death	Days away from work	Remained at work		Away From Work (days)	On job transfer or restriction (days)	(M) Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
						Job transfer or restriction	Other record-able cases								
				(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
	2-9	Box of International Truck	Laceration to R hand			X		0	6	X					
	3-3	Powder Line Unloading	Twisted back			X		0	2	X					
	3-9	Powder Racking	Smashed fingers (4 & 5) R hand			X		0	5	X					
bler	5-10	Plastics Assembly	L middle finger smash / contusion			X		0	6	X					
	5-11	Powder Booth #1	Splinter that when removed needed sutures				X	0	0	X					
	6-8	Box of International Truck	Fracture R big toe - no steel toes				X	0	0	X					
	6-20	Plastics - Paint Booth	TBD			X		0	7	X					
	6-24	Powder - Racking	Laceration to L arm			X		0	3	X					
	7-15	Buffing - Plastics Line	Tendonitis L hand			X		0	17	X					
	8-25	Powder Line	Laceration top of R hand				X	0	0	X					
bler	~~10-27~~	~~Plastics Buffing~~	~~L thigh strain~~					~~9~~							
	11-4	Plastics Buffing	R arm pain			X		0	14	X					
ibor	11-7	Powder Racking	L oblique strain			X		0	6	X					
isor	11-10	Powder Washer Chem Tank	R ankle fracture			X		0	14	X					
			Page totals	*0*	*0*	*10*	*3*	*0*	*80*	*13*	*0*	*0*	*0*	*0*	*0*

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
(1)	(2)	(3)	(4)	(5)	(6)

r is estimated to average 14 minutes per response, including time eeded, and complete and review the collection of information. f information unless it displays a currently valid OMB control ales or any aspects of this data collection, contact: US N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do

, (Rev. 01/2004)

rk-Related Injuries and Illnesses

Year 2005

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no 1218-0176

nplete this Summary page, even if no injuries or review the Log to verify that the entries are complete

ide for each category. Then write the totals below. page of the log. If you had no cases write "0."

tatives have the right to review the OSHA Form 300 in OSHA Form 301 or its equivalent. See 29 CFR r details on the access provisions for these forms.

Total number of cases with job transfer or restriction	Total number of other recordable cases
10	3
(I)	(J)

Total number of days of job transfer or restriction

80
(L)

(4) Poisoning	0
(5) Hearing Loss	0
(6) All Other Illnesses	0

r 1 to April 30 of the year following the year covered by the form

imated to average 50 minutes per response, including time to review the instruction, search and on of information. Persons are not required to respond to the collection of information unless it ny comments about these estimates or any aspects of this data collection, contact: US Department of tion Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name: Crystal Finishing Systems - Facility 3

Street: 4807 Bayberry St

City: Schofield State: WI Zip: 54476

Industry description (e.g., Manufacture of motor truck trailers)
Coatings Applicator

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)
3 4 7 9

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
3 3 2 8 1 2

Employment information

Annual average number of employees: 68

Total hours worked by all employees last year: 144032.5

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Mark Matthiae
Company executive

President
Title

715-355-5351 x225
Phone

1/30/2006
Date

) (Rev. 01/2004)

Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 2006

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

ed injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment ork-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related ecording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office

Establishment name: Crystal Finishing Systems - Facility 3

City: Schofield State: WI

Describe the case				Classify the case											
(C) Title (e.g., /Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
				Death	Days away from work	Remained at work		Away From Work (days)	On job transfer or restriction (days)	(M) Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
						Job transfer or restriction	Other record-able cases								
				(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
mbler	1-9	Assembly	L lumbar strain		X			3	14	X					
ler	~~1-24~~	~~Powder Line~~	~~Walking~~												
~~Labor~~	~~1-25~~	~~Fulton Line~~	~~R rib contusion & R trap strain, R wrist sprain~~												
~~er Lead~~	~~11-18-05~~	~~Paint Area~~	~~back pain~~					0	0						
Labor	5-1	Loading	R foot contusion			X		0	2	X					
~~Labor~~	~~4-17~~	~~Fulton Line~~	~~not sure which knee at this time~~												
ler	6-6	Plastic paint booth	back strain			X		0	6	X					
er	7-1	Plastics	Rib contusions				X	0	0	X					
mbler	7-17	Assembly	pinched left ring finger				X	0	0	X					
er	7-28	Fulon line area	scratched cornea, minor eye irritations				X	0	0	X					
er	9-18	Paint Booth	Hip popped		X			7	0	X					
	10-5	Buffing	L arm strain			X		0	29	X					
r	10-19	Buffing	R elbow pain			X		0	20	X					
~~Labor~~	~~10-27~~	~~Wet Sand~~	~~R side muscle sprain~~												
ler/loader	11-13	Loading	R, L shoulder strain				X			X					
			Page totals	*0*	*2*	*4*	*4*	*10*	*71*	*10*	*0*	*0*	*0*	*0*	*0*

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

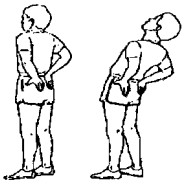
Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
(1)	(2)	(3)	(4)	(5)	(6)

ion is estimated to average 14 minutes per response, including time needed, and complete and review the collection of information of information unless it displays a currently valid OMB control mates or any aspects of this data collection, contact: US m N-3644, 200 Constitution Ave. NW, Washington, DC 20210. Do

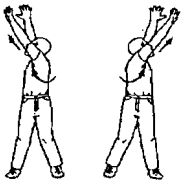
Appendix B: Bureau of Labor Statistics Yearly Injury Data for Private Industry Similar to CFS

Incidence rates (1) of nonfatal occupational injuries and illnesses involving days away from work (2) by selected worker and case characteristics and industry, All U.S., private industry, 2003 - 2005				
Characteristic	Private industry (3) (4) (5)	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers		
	2005	2003	2004	2005
Total:	135.7	220.7	155.8	223.7
Number of days away from work:				
Cases involving 1 day	19.4	42	24.2	54.4
Cases involving 2 days	15.8	21	27.1	29.2
Cases involving 3-5 days	25.8	46.2	24.9	55.1
Cases involving 6-10 days	17.3	33.6	14.4	35.1
Cases involving 11-20 days	15.7	10.5	22.1	8
Cases involving 21-30 days	8.9	23.1	11.4	-
Cases involving 31 or more days	32.9	46.2	31.7	40.3
Nature of injury, illness:				
Sprains, strains	55.3	92.5	38.4	85.5
Fractures	10.5	25.2	-	16.8
Cuts, lacerations, punctures	13.1	14.7	20.2	21.2
Bruises, contusions	11.8	16.8	13.7	6.2
Heat burns	1.9	-	-	-
Chemical burns	0.7	-	-	8.7
Amputations	0.9	-	-	-
Carpal tunnel syndrome	1.8	-	-	-
Tendonitis	0.6	-	-	-
Multiple injuries	5.5	-	12.7	-
With fractures	1.1	-	-	-
With sprains	2.3	-	-	-
Soreness, Pain	11.1	-	21.7	27.1
Back pain	3.9	-	-	19.4
All other	22.4	35.7	28.4	44.8

Appendix C: Stretching Program and the Techniques Used

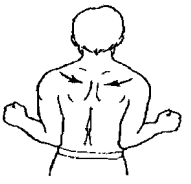


1. Place hands firmly against hips as shown
2. Bend backward until you feel a mild stretch
3. Hold 5 - 10 seconds
4. 3 - 5 repetitions

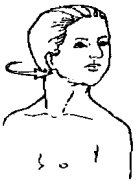


1. Stand with arms overhead
2. Reach up behind to either side
3. Hold 5 - 10 seconds
4. 3 - 5 repetitions each side

1. Lean to the side until you feel a stretch, with arm overhead as shown
2. Hold 5 - 10 seconds
3. 3 -5 repetitions each side



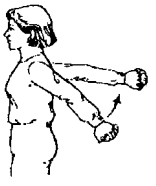
1. Stand with elbows bent to 90 degrees
2. Draw shoulder blades together as you rotate arms outward
3. Hold 5 - 10 seconds
4. 3 - 5 repetitions



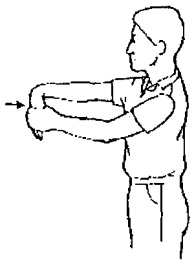
1. Sit or stand with good posture
2. Turn head smoothly to one side
3. Hold 5 seconds, then turn to other side
4. 3 - 5 repetitions each side

1. Sit or stand with one arm behind back as shown
2. Keeping face forward, use other hand to gently stretch the opposite direction
3. Hold 5 - 10 seconds
4. 3 - 5 repetitions

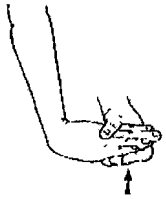
1. Stand grasping one elbow with other hand as shown
2. Pull the elbow and arm across your chest so that you feel a comfortable stretch
3. Hold 10 seconds
4. 3 - 5 repetitions



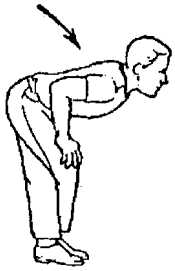
1. Stand with hands clasped together behind back as shown
2. Press hands backward so that you feel a stretch
3. Hold 5 - 10 seconds
4. 3 - 5 repetitions



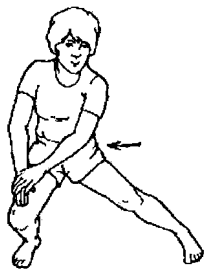
1. Hold each wrist as shown
2. Bend the wrist until you feel a gentle stretch
3. Hold 10 - 30 seconds
4. 2 - 3 repetitions each



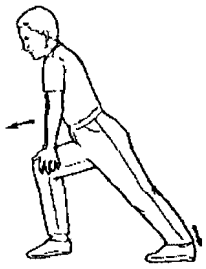
1. Hold each wrist as shown, making sure to keep fingers straight
2. Bend the wrist and fingers upward until you feel a stretch
3. Hold 10 - 30 seconds
4. 2 - 3 repetitions each



1. Stand bearing most of your weight on your back leg
2. Cross the other leg in front as shown
3. Lean forward, bending at the hip and keeping your back straight
4. Hold 10 - 30 seconds
5. 2 - 3 repetitions each



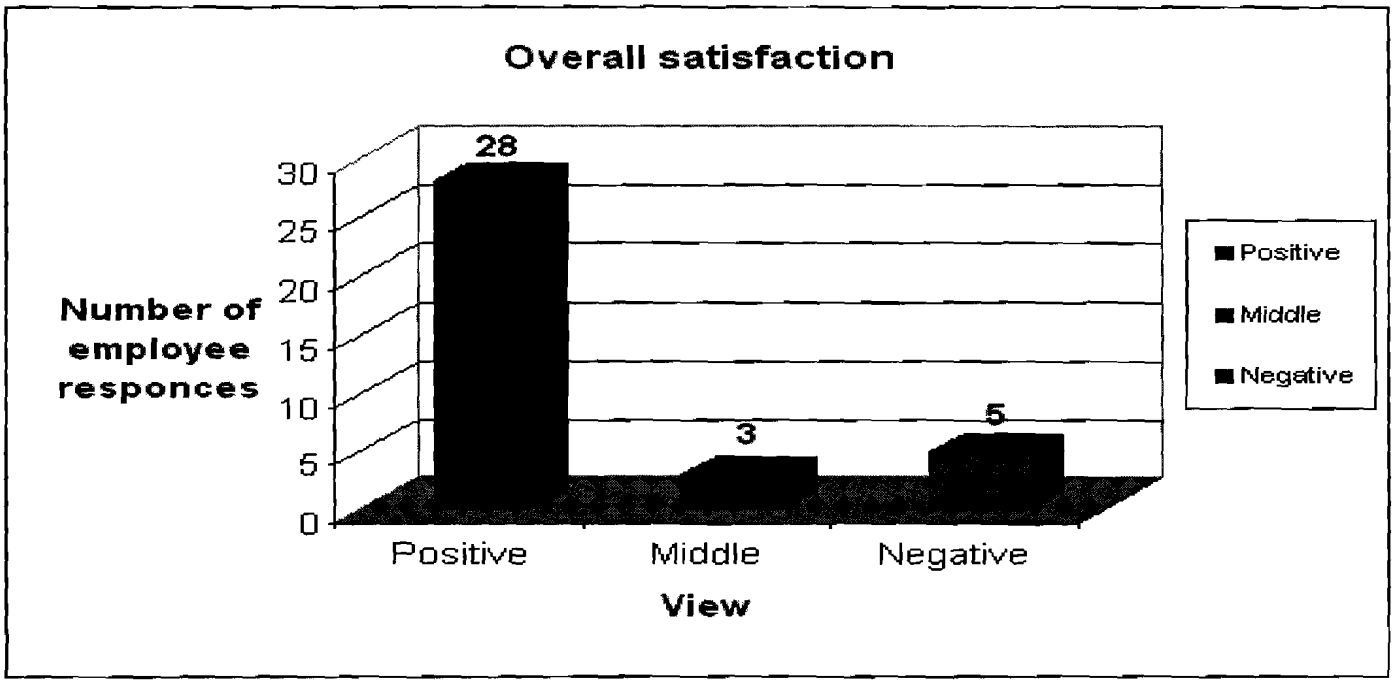
1. Assume a "half-squat" position as shown, with one leg out to the side
2. Press inside of thigh downward, by shifting weight toward the bent leg
3. Hold 10 - 30 seconds
4. 2 - 3 repetitions each

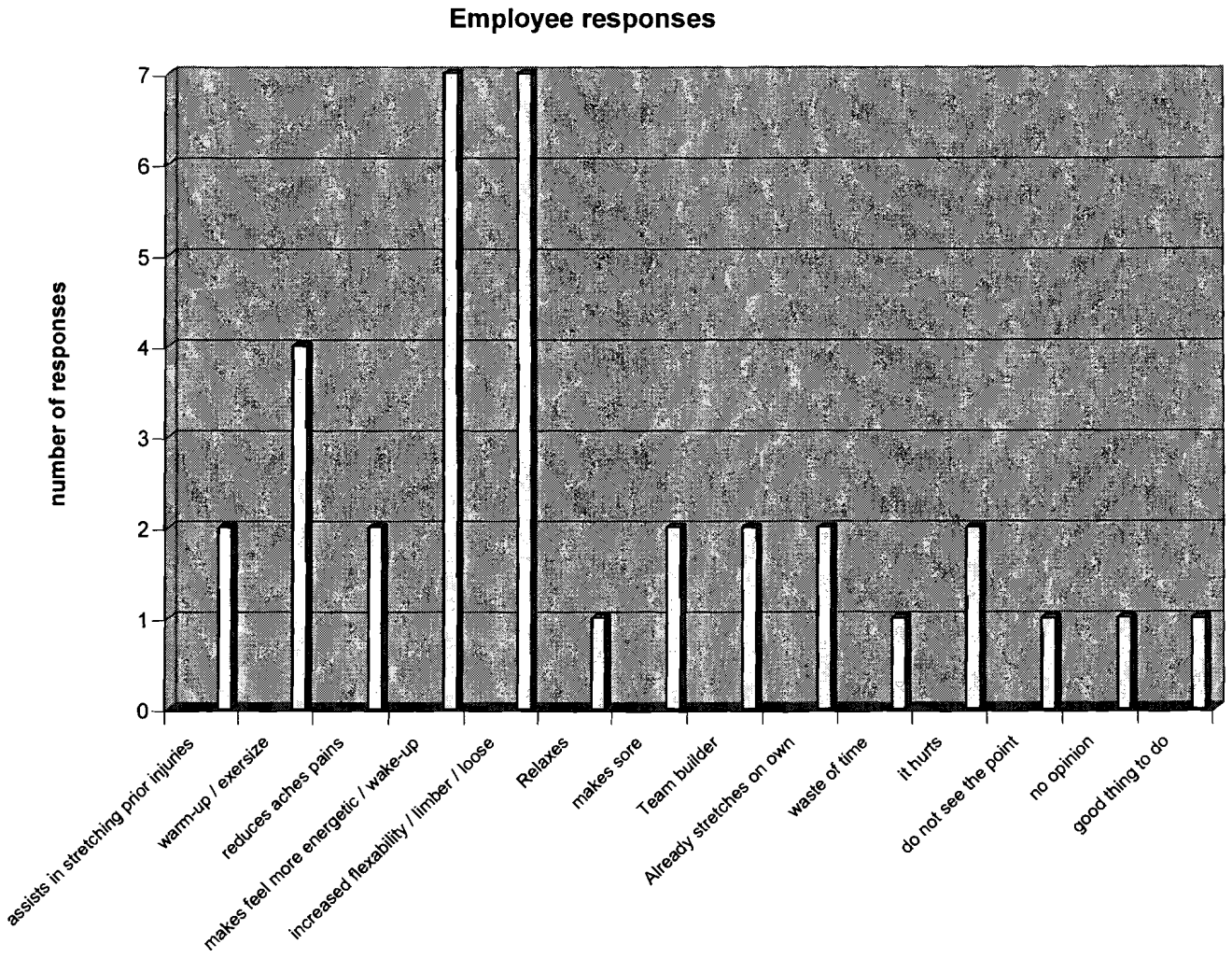


1. Assume position shown with one foot behind
2. Point toes directly forward, and hold heel down
3. Lean forward onto your knee so that you feel a stretch
4. Hold 10 - 30 seconds
5. 2 - 3 repetitions each

Appendix D: Results of Survey on Employee Satisfaction with Stretching Program

Positive	28
Middle	3
Negative	5




Employee responses
number of responses
0
1
2
3
4
5
6
7
assists in stretching prior injuries
warm-up / exersize
reduces aches pains
makes feel more energetic / wake-up
increased flexability / limber / loose
Relaxes
makes sore
Team builder
Already stretches on own
waste of time
it hurts
do not see the point
no opinion
good thing to do

Appendix E: Data Gathered From $afety Pays Program

Simple data entry of type of injury was used to get the following results.

```
================================================================

                    $ A F E T Y   P A Y S !

   Estimated Costs of Occupational Injuries and Illnesses and
        Estimated Impact on a Company's Profitability

              Report for Year:  2006

              Employer:  CFS

              Prepared by:  Noah on May 09, 2007


----------------------------------------------------------------

         Since you do not know the profit margin and we can't calculate
         it, the system will use the default profit margin.
                        WE USE 3%.
         The injury or illness selected:          Sprain.
         Average Direct Cost:                     $4245
         Average Indirect Cost:                   $6792
         Estimated Total Cost:                    $11037
         The ASSUMED net profit margin on sales is:  3%.
         The ADDITIONAL sales necessary
         - to cover Indirect Costs are:           $224136
         - to cover Total Costs are:              $364221
       ------------------------------------------------------------
         The injury or illness selected:          Strain.
         Average Direct Cost:                     $5945
         Average Indirect Cost:                   $7134
         Estimated Total Cost:                    $13079
         The ASSUMED net profit margin on sales is:  3%.
         The ADDITIONAL sales necessary
         - to cover Indirect Costs are:           $235422
         - to cover Total Costs are:              $431607
================================================================
     The TOTAL ADDITIONAL SALES required by these 2 incidents
     is estimated to be between:

                    $459558 and $795828.


     The extent to which the employer ultimately pays the direct
     costs depends on the nature of the employer's workers'
     compensation insurance policy.  The employer always pays
     the indirect costs.

     This report is produced by OSHA's Safety Pays software.  Look
     for OSHA software on the World Wide Web at www.osha.gov.
```

Appendix F: Consent to Use CFS for the Study

In this appendix is an email from the researcher to the CEO and President of CFS for permission to use his facilities in research.

Noah,

You have permission to use Crystal Finishing Systems Inc. in your Thesis.

Thanks

Mark Matthiae Pres.

-----Original Message-----

From: Starr, Noah J [mailto:starrn@uwstout.edu]

Sent: Thursday, July 20, 2006 10:08 AM

To: Mark Matthiae

Subject: Thesis Permission

Mark,

I know you gave me verbal permission to use Crystal Finishing Systems, Inc. for my thesis. A response to this email will suffice as granted permision as I can simply print this document for verification to utilize the name Crystal Finishing Systems, Inc.

Thank you once again and let me know if there are any questions,

Noah Starr